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PAUL M. KELLY

U. S. DEPARTMENT OF AGRICULTURE.

Clemson University



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REPORT

OF

FEB 25 1902

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THE FORESTER

FOR

1902.

BY

GIFFORD PINCHOT.

[FROM ANNUAL REPORTS, DEPARTMENT OF AGRICULTURE.]



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GOVERNMENT PRINTING OFFICE,

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REPORT OF THE FORESTER.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF FORESTRY,
Washington, D. C., September 1, 1902.

SIR: I have the honor to transmit herewith a report of the work of the Bureau of Forestry for the fiscal year ended June 30, 1902, together with an outline of the plans for the work of the Bureau for the current fiscal year.

Respectfully,

GIFFORD PINCHOT,
Forester.

Hon. JAMES WILSON, *Secretary.*

WORK OF THE YEAR.

INTRODUCTION.

During its first year as a Bureau, the former Division of Forestry has rapidly assumed the character and functions of its new position. With the increased capacity to do its work, the Bureau has gained in stability and effectiveness, and in the character and value of its results. While from the lack of American foresters it yet falls below a high standard of equipment in trained men, a larger proportion of educated foresters than ever before was engaged in its work, both in the office and in the field. The organization of work made possible by the change from a Division to a Bureau has been of capital value throughout the year.

The progress of public interest in forestry during the year far more than kept pace with the growth of the Bureau. The demands for advice and assistance increase from month to month, and continue to outstrip more and more the ability of the Bureau to meet them. The time for the general introduction of practical forestry in the United States is evidently at hand, provided only the necessary information and assistance can be supplied. The inability of the Bureau of Forestry to meet this demand because of inadequate resources is thus the most serious bar to the protection and perpetuation of our forests. With the rapid extension of professional education in forestry, the need of the Bureau for trained foresters can next year be met more nearly than ever before. In view of the increasingly rapid destruction of our forests, it is most fortunate that the imperative demand for assistance in checking the loss is paralleled by the opportunity to supply the demand, if only the necessary resources in money are made available.

SUMMARY.

FOREST MANAGEMENT.

Private lands.—The demands for assistance in introducing practical forestry on private lands increased during the past year almost as much as during the three preceding years. These applications have now reached a total of 4,709,120 acres, under an arrangement by which the owners pay all expenses of the field work except the salaries of members of the Bureau.

The total area of private forests under conservative management, however, reached only the comparatively insignificant total of 372,463 acres, or 7.9 per cent of the total applications. The Bureau has thus been obliged, for lack of men and money, to neglect or defer over 90 per cent of its opportunities to introduce practical forestry on private lands.

It must not be forgotten that the overwhelming bulk of the forests in the United States are in private ownership, and that forest protection by the Government, while absolutely of vast importance, is relatively insignificant when compared with the action of the lumbermen and other private owners. In the light of these facts, the inability of the Bureau to respond to more than 8 per cent of the requests for advice in applying the principles which it continually advocates is seen to be the most dangerous of all checks on the progress of forestry.

Field work on seven large forest tracts was completed during the year, and preliminary examinations were made of 1,620,000 acres. The amount paid by the owners for the expense of working plans was \$13,325.

Public lands.—The preparation of working plans for conservative lumbering on the public forest reserves, at the request of the Secretary of the Interior, has continued throughout the year. The total area of these reserves, September 1, 1902, is 58,850,925 acres. Field work was carried on during the past year in five reserves. In addition to field work and the computation of results in the office, the force of the Bureau was drawn upon to supply the entire lack of trained foresters in the management of the National forest reserves.

During the year a request was made by the Secretary of War for working plans for eight military wood and timber reservations, with a total area of 117,468 acres. Among these is the military reservation at West Point, upon which field work will be begun without delay.

Field work was completed on townships 5, 6, and 41 of the Adirondack Forest Reserve by the use of an appropriation of \$3,500 made by the New York legislature to cover the field expenses of the Bureau of Forestry.

Forest measurements.—The force employed in computing field results was thoroughly organized. It completed during the year computations of 16,678 acres, and measurements of the rate of growth of 10,786 trees, of 25 species, in 13 States.

FOREST INVESTIGATION.

Commercial trees.—Measurements and sylvicultural facts were gathered for 20 species in various parts of the country. Studies of hardwood sprout lands were carried on in Massachusetts and other parts of New England, and promise valuable results. A special investiga-

tion of the Big Trees of California was begun and is still in progress, and a preliminary study of the swamp forests of eastern Missouri and Arkansas was undertaken.

Studies of North American forests.—The forests of Nebraska were made the subject of an elaborate report, and at the request of the Michigan forest commission an investigation of lands in the southern peninsula of Michigan was made, with special reference to the proper management of the Michigan Forest Reserve. Special studies of forest conditions were pushed forward in Kentucky, Ohio, and Texas, and of the distribution of forests in certain portions of New Mexico, Arizona, South Dakota, Wyoming, Montana, and California. In California the study of the relation of forest cover to the flow of streams was continued, and the results will shortly be ready for publication. In cooperation with the U. S. Geological Survey the study of the Sierra Forest Reserve was completed. In Vermont a cooperative study of the forest resources and conditions of the State was completed, and in Maryland the mapping of the forests by counties, begun in 1899, was continued. Attention was given, both in the office and in the field, to the region of the proposed Appalachian Forest Reserve.

Fires and grazing.—Investigations of the effect of grazing on the forest were conducted in Washington, Oregon, Wyoming, New Mexico, Utah, and California. The study of forest fires was conducted in 12 States, and work was pushed on the preparation of a report.

Dendro-chemical investigations.—Special attention has been given during the year to the chemical investigation of tan extracts from native woods and barks, and of gums from the Philippine Islands. The study of pulp woods, with special reference to the qualifications of untried species, has been carried forward.

Turpentine orcharding.—The investigation conducted by the Bureau into the methods of producing naval stores in the Southeastern United States has resulted in the development of a method which it is believed will radically affect the whole industry. A report is in preparation describing its actual operation.

Forest entomology.—In cooperation with the Division of Entomology, a beginning was made in the investigation of insect damage to the forest, with the direct purpose of devising remedies. The vast importance of the subject makes the continuance of this work imperative.

Various studies.—Investigations of the lumber industry of the State of New York and the maple sugar industry of the United States were completed, and a study of the osier willow industry was begun.

A careful investigation of the Eucalypts and Acacias cultivated in the United States was completed, and bulletins were prepared for each.

Timber construction and supplies.—In cooperation with the Bureau of Plant Industry, great progress was made during the year in arousing the interest of mining and railroad companies in the preservation of timbers and in the sources of timber supply. The practical assistance of many railroads toward the establishment of conservative forestry was begun, and the work shows conspicuous promise.

Forest exhibit.—A forest exhibit was prepared and installed at the Pan-American Exposition at Buffalo, and later transferred to Charleston, S. C.

TREE PLANTING.

Planting plans.—The cooperation of the Bureau of Forestry with the owners of timber land is paralleled by its cooperation with the owners of treeless areas who wish to plant. Up to June 30, 1902, there were received 262 applications for assistance, in response to 224 of which planting plans were prepared. In the course of the work 197,439 acres of land were examined. The area to be planted under plans already prepared is 6,474 acres. These plans cover 29 States and Territories and 172 different localities.

Planted woodlands.—In order to use the information already at hand from previous planting, careful studies of 20 large plantations, 8 in the Middle West and 12 in the East, were carried on during the year. A similar study is now under way to find trees adapted for the Southwestern plains.

Forest extension.—Studies of the natural extension of forests were continued during the year. A careful forest survey of a large part of Nebraska was completed, and resulted not only in arousing great interest throughout that State, but in the creation of two forest reserves for tree planting, a most valuable contribution to the forest policy of the United States.

Reserve planting.—Preparations for planting considerable areas in the two reserves in Nebraska were made during the latter part of the fiscal year.

Sand dunes.—Investigations with a view to preventing damage from drifting sand dunes were begun during the year, both on the Atlantic and Pacific coasts, and promise results of great value, especially along the Columbia River.

RECORDS.

Office work.—The office work of the Bureau has continued to increase steadily in efficiency throughout the year.

The collection of forest literature from the Department Library was transferred to the library of the Bureau, which now contains 1,120 bound volumes, 1,900 pamphlets, and numerous periodical publications.

The photographic collection was largely increased, and is now serving as the source from which nearly all forest illustrations are derived.

The correspondence of the Bureau increased until the number of mail pieces forwarded during the year was 24,538.

Eight new publications and 10 reprints were printed during the year, with a total number of 77,200 and 127,500 copies, respectively.

A photographic laboratory was prepared at the quarters of the Bureau, and was nearly ready for occupancy at the end of the fiscal year.

FOREST MANAGEMENT.

PRIVATE LANDS.

During the past year the Bureau of Forestry has continued to give advice and practical assistance to private forest owners. The demands upon this branch of its work have increased steadily, and they are now even further beyond its capacity than at the end of the previous fiscal year. In the Southern States in particular there has been a

rapid awakening to the advantages of practical forestry, and a growing appreciation of the opportunity open to private forest owners through the offer of cooperation made by the Bureau in Circular No. 21, which gives the terms on which farmers, lumbermen, and others may cooperate with the Bureau in handling their forest lands. Wood lots, not exceeding 200 acres, are studied without cost to the owner, but in the preparation of detailed working plans for larger tracts the Bureau and the owner share the expenses of the work, the former paying the salaries of its men and the latter their traveling and field expenses. From July 1, 1901, to July 1 of the present year, 37 applications have been received from private owners for advice and assistance in the management of their forest lands. Twenty-five were for timber tracts and 12 for wood lots. They reach a total of 1,904,476 acres. The total area of private lands, in handling which assistance has been requested since the publication of Circular No. 21, in October, 1898, to July 1, 1902, is 4,709,124 acres.

WORKING PLANS MADE.

The field work necessary for detailed working plans was completed during the year for seven tracts with a total area of 421,000 acres in Maine, New York, Michigan, South Carolina, and Tennessee. The total amount estimated as the cost of these working plans to the owners was \$9,725 and the total amount actually expended was \$9,040.86.

One of these working plans was for a tract of 110,000 acres in Polk and Monroe counties, Tenn., on the western slope of the Smoky Mountains. The field work occupied a party of 12 men for six months. It included a thorough study of the forest, the habits and rates of growth of the timber trees, and their behavior after lumbering. A careful investigation was made in order to determine what modifications of present methods of lumbering will leave the forest in good condition without seriously impairing present profits. The stand was actually measured upon 1,500 acres, and 1,200 measurements of volume and rate of growth were made upon felled trees. The tract was divided into blocks, according to watersheds, and the stand of each of the merchantable kinds was computed separately for each block. The silvicultural problem was very complicated because of the large number of species in the forest mixture. Only a few of these have as yet any market value, and it was difficult to determine how the tract may be lumbered so that the reproduction of the few valuable kinds may hold its own against that of the less valuable trees upon the lumbered areas. Careful studies were made of the habits of the more important trees and of the other local conditions which determine the form of management. Methods for the effective protection of the forest from fire were thoroughly investigated. The principal recommendations of the working plan may be summarized as follows:

(1) A diameter limit is set for each of the commercial trees, below which none may be cut.

(2) A certain number of trees above the diameter limit recommended should be marked and left standing to serve as seed trees.

(3) Contracts for the sale of stumpage should provide that a certain quantity of the less valuable kinds be cut and removed with the valuable trees. This should be done in order to leave the forest after lumbering in a condition favorable to the reproduction of the valuable kinds, the chief object of the working plan being to produce a future

stand of timber in which Yellow Poplar, Ash, Hickory, Walnut, and White Oak will be much better represented than in the present forest.

(4) A plan is outlined for the protection of the cut-over lands against fire.

The application of practical forestry to this tract is exceedingly important as a long step toward the adoption of conservative forest methods in the Southern Appalachians.

Another tract for which a detailed working plan was prepared lies in Scott, Campbell, and Anderson counties, Tenn., and has an area of 50,000 acres. The field work occupied a party of 10 men for four months. The tract is situated in the bituminous coal district of the Cumberland Mountains, and in addition to a valuable stand of hardwoods the property contains numerous accessible veins of soft coal, for which a good market exists. The object of the owners is to lumber conservatively in conjunction with mining operations. The main object to be worked for is to combine present profits with a valuable second crop. To this end the more valuable species will be favored in the lumbering and so given every chance to reproduce themselves well. The present forest is a mixture of hardwoods with a sprinkling of White, Shortleaf, and Scrub Pine, and Hemlock. It is remarkable for the number of species. Among the more important are Yellow Poplar, Ash, Hickory, White Oak, Chestnut Oak, Black Oak, Post Oak, Black Walnut, and Black Cherry. Most of the merchantable timber stands in the coves or hollows, while the slopes are covered by an open and less valuable growth. As a basis for an estimate of the stand of merchantable timber, all the trees were actually measured on 2.5 per cent of the total area. To ascertain the merchantable contents and the rate of growth of the commercial kinds, measurements called stem analyses were made of 2,474 felled trees. For greater accuracy, the tract was divided into 18 blocks, the boundaries of which correspond to the boundaries of the smaller watersheds, and the stand was calculated separately for each block. The working plan contains detailed silvicultural descriptions of the three principal types of forest growth—cleveland, Chestnut Oak slope, and Black Oak slope. It also discusses the silvicultural characteristics of the most important species, and gives diagrams showing their rate of growth in diameter, height, and merchantable contents. The regulations for lumbering give the diameters for each species, under which no tree should be cut, and direct that certain trees of the more valuable species above this diameter limit be marked and left standing to furnish seed for a second crop after lumbering. A plan is outlined for the protection of cut-over lands from fire, and recommendations are made concerning transportation and contracts for the sale of stumps. The working plan is accompanied by a forest map, showing the distribution of the important timber trees. The conditions on this tract are peculiarly favorable to the successful application of practical forestry.

A tract of 60,000 acres for which the field work was completed is that of the Okeetee Club, in Beaufort and Hampton counties, S. C. The important tree here is the Longleaf Pine. As a result of the past management, the forest varies irregularly from mature stands to young woods, and is broken by occasional patches of open ground, where heavy cutting followed by fire has destroyed the forest altogether. The hearty cooperation of the Okeetee Club in the scientific investigations of the Bureau of Forestry and the exceptional oppor-

tunity for experimentation which is offered combine to give this piece of work peculiar usefulness.

The working plan deals mainly with the following points:

- (1) An accurate estimate of the stand of merchantable timber.
- (2) A study of the rate of growth of the Longleaf Pine.
- (3) A system of fire protection and the organization and instruction of a fire service.
- (4) A plan to foster and increase the reproduction of the Longleaf Pine.

(5) Where lumbering operations should begin, how they should be carried on, to what extent the timber should be cut, what yield should be expected, what would be the expense of cutting and marketing under proper rules, and what financial results might be expected.

The preparation of the working plan for a tract of 10,000 acres on Grand Island, Michigan, gave useful results. The field work necessary for a working plan occupied a party of 6 men for two months. The stand was actually measured upon 301 acres, and 299 measurements of contents and rate of growth were made upon felled trees in addition to careful silvicultural studies of the more important species. The forest is composed of hardwoods of large size, which, from the nearness of a strong market, are of high value. There is here an unusually good opportunity for conservative forest management, upon a paying basis from the start.

The tract of the Moose River Lumber Company, of 15,000 acres in Herkimer County, N. Y., was studied by a party of 4 men for four months, and the data necessary for a working plan were collected. The area is equally divided between virgin and cut-over land. On the latter there is a fair amount of small spruce among the first growth of hardwoods, while the former contains in addition a fine stand of mature spruce. The Moose River Lumber Company operates its own mill at McKeever, and can therefore manufacture its own product without the expense of long transportation for its logs. The unusually good opportunity for conservative forest management rendered the preparation of a working plan for this tract of decided importance.

The sixth tract upon which the Bureau completed field work during the past fiscal year includes 150,000 acres of the 275,000 acres in north-western Maine which belong to the Great Northern Paper Company. The field work occupied a party of 20 men for four months. It included complete measurements of the stand upon 3,303 acres, and of the volume and rate of growth upon 900 felled trees. Careful study was made of the Red Spruce and Balsam, which are here, both commercially and in number of individuals, the most important trees. The chief problem in the management is so to modify the present methods of lumbering that the Spruce may hold its own in the reproduction on cut-over areas. A part of the field work was the preparation of a map of the tract to show the topography and the burnt-over lands, the lumbered areas, the virgin forest, and the forest types.

The field work necessary to a working plan for the 15,000-acre tract of Mr. E. H. Harriman, near Arden, N. Y., was begun April 1 and completed June 15. It was carried out entirely by 9 students, constituting the senior class of the Yale Forest School, under the immediate direction of Prof. Henry S. Graves, formerly assistant chief of the Division of Forestry, and still a collaborator of the Bureau. A forest map of the entire tract was made, as well as a careful study of the forest, by which its character, condition, present stand, and future yield were ascertained.

The working plan will deal with the following topics:

Part I:

The purpose and scope of the examination.

Character of the forest, including a general description of the distribution of trees, distribution of age classes, merchantable yield, present condition of the timber, future production, etc.

Recommended treatment of the forest, including a description of the thinnings actually made.

Financial possibilities of the forest.

Part II:

Detailed description of the forest by compartments.

Forest map.

Silvicultural study of the forest.

During the spring about 100 acres were thinned under supervision, and about 1,000 cords of wood were cut.

WORKING PLANS IN PREPARATION.

Personal examinations were made during the year of 10 timber tracts in the States of Georgia, Tennessee, North Carolina, South Carolina, Texas, Pennsylvania, and New York, covering a total area of 1,620,600 acres. The preparation of detailed working plans was recommended for six of the timber tracts examined and the recommendation in each case was approved by the owners, at a total estimated cost to them of \$10,100.

The largest and most important of these tracts is that of the Kirby Lumber Company and the Houston Oil Company, in southeastern Texas. It comprises an area of 1,250,000 acres, and includes practically all of the virgin Longleaf Pine land in the 7 counties in which it is situated. The forest is divided into three principal types: Longleaf Pine land, Shortleaf Pine land, and hardwood bottom land. The first covers about 80 per cent of the total area and is commercially the most important.

The opportunity for practical forestry on these lands is unusually good. The tract consists largely of pure woods of Longleaf Pine, only about 15 per cent of which have been cut over. With reasonable protection the reproduction is assured, while the presence of a heavy stand of mature timber, the absence of underbrush, and the flatness of the country are conditions exceedingly favorable to clean, conservative lumbering.

The points which will be chiefly studied in the preparation of the working plan are the following:

(1) The present method of lumbering and its effect upon the forest, in order to ascertain what practicable modifications will hasten the production and improve the quality of a second crop.

(2) The reproduction of the Longleaf Pine and the rate at which it produces timber.

(3) The effect of fire on the Longleaf Pine, and the fire problem in general, in order to devise a simple and effective system of protection. Whether this system should include the whole area of the forest or should, as seems probable, deal only with the protection of lumbered areas until the reproduction is old enough to be comparatively safe, can be decided only by a thorough study on the ground.

(4) The railroad tie industry, its effect upon the forest, and its commercial wisdom under the methods and to the diameter to which trees are now cut for ties.

Another valuable opportunity for practical forestry is offered by a

tract of 72,000 acres, the property of E. P. Burton & Co., situated in Berkeley County, S. C. The principal species are Loblolly and Longleaf Pine. Ease of lumbering and transportation and excellent reproduction render this tract one of the most promising with which the Bureau has yet had to deal.

A third tract for which an examination was made, a working plan advised, and its preparation approved by the owners, is that of the Linville Improvement Company, in Mitchell, Caldwell, and Watauga counties, N. C. It has an area of 16,000 acres. The forest is composed chiefly of broadleaf species, among which Yellow Poplar, Yellow Birch, and the oaks are the most important. It presents an interesting silvicultural problem in addition to conditions exceedingly favorable to conservative management upon a sound financial basis.

A smaller but not less promising tract which has been examined, and for which a working plan is now being made, lies on the west side of the Susquehanna River, 13 miles above Harrisburg, Pa., and has an area of 2,300 acres. The owner wishes to hold it as a permanent investment and to manage it with this end in view. With the exception of about 200 acres the forest is composed entirely of sprout growth of Chestnut, Rock Oak, White Oak, and Hickory, together with excellent Scrub, White, Shortleaf, and Jack Pine. A strong market exists for all kinds of forest produce, and transportation facilities are good.

PUBLIC LANDS.

The preparation of working plans for the National forest reserves is one of the urgent pieces of work before the Bureau. It has arisen from the request upon the Secretary of Agriculture from the Secretary of the Interior for advice as to the best management of the reserves, which now comprise a total area of 58,850,925 acres. The study on the ground necessary to a working plan was carried on during the past year in the Prescott Forest Reserve, Arizona, which contains 423,680 acres, the Priest River Forest Reserve, in Idaho, with an area of 645,120 acres, and the Big Horn Forest Reserve, in Montana, which includes 1,216,960 acres. The field work in the Prescott Reserve occupied a party of 11 men for three months. Measurements of the stand were taken upon 1,648 acres, and 1,840 measurements were made of volume and rate of growth; the Bull Pine was carefully studied, particularly with reference to the effect of the present methods of lumbering upon the reproduction of the tree, and the data were obtained for a comprehensive plan for the best management of the reserve with due regard to its value in the production of timber and in maintaining the water supply. The field work carried on in the Big Horn Reserve occupied a party of 7 men a period of four months. The stand was measured on 820 acres, and 1,299 measurements made upon felled trees. In the Priest River Reserve a party of 6 men were at work for three months. The stand was measured upon 879 acres, and 720 measurements of volume and rate of growth were made.

A thorough preliminary examination preparatory to a working plan is now being made of the San Francisco Mountains Forest Reserve, in Arizona.

The field work necessary to a working plan for townships 5, 6, and 41, Hamilton County, N. Y., in the Adirondack Forest Reserve, was begun and completed during the past fiscal year. It became possible through an appropriation of \$3,500 by the New York legislature to

cover the field expenses of the agents of the Bureau engaged in the work. The area of these three townships is 69,916 acres, and the necessary studies on the ground occupied a party of 16 men for four months. The work was carried on upon lines similar to those followed in the preparation of a working plan for township 40, Hamilton County, which has already appeared as Bulletin No. 30, Division of Forestry. Measurements of the total stand were made upon 3,471 acres and of volume and rate of growth upon 2,081 felled trees. A careful study was made of the forest, not only from the point of view of the forester, but also from that of the lumberman, and a map was prepared for the three townships showing the combined work of both. This map, in addition to the forest types, gives information necessary to the best lumbering of the tract, showing desirable sites for splash dams, and indicating necessary improvements of streams for driving and other points of practical value to the lumberman.

MILITARY RESERVATIONS.

An important piece of work which will be taken up as rapidly as the force and appropriation of the Bureau will permit has arisen through the request by the Secretary of War upon the Secretary of Agriculture for technical advice governing the handling of military wood and timber reservations. These are eight in number and comprise a total area of 117,468 acres.

A preliminary examination has already been made of the West Point Military Academy Reservation of 2,000 acres stocked with second-growth hardwoods, and a detailed working plan has been recommended and field work will soon begin. An excellent opportunity is offered for thinnings which will materially improve the character of the forest and at the same time yield a supply of firewood for the use of the Academy.

FORESTS UNDER MANAGEMENT.

The working plan prepared in 1901 for the tract of the Sawyer & Austin Lumber Company, of Pine Bluff, Ark., and which has been published as Bulletin No. 32 of the Bureau of Forestry, was put into effect in March, 1902. The forest is a mixture of Shortleaf and Loblolly Pine, with scattered hardwoods, the pine only being cut to a diameter of 14 inches on the stump. The tract was visited by agents of the Bureau and the area to be cut over within the next year, approximately 6,400 acres, was carefully examined. On this area a certain number of Loblolly and Shortleaf pines to be left as seed trees were marked and stamped. They average one tree to 6 acres. It is estimated that there will be left after lumbering at least six seed trees below a diameter of 14 inches, and it is believed that with the larger trees referred to above they will amply suffice to seed up the cut-over lands. The Loblolly grows more rapidly than the Shortleaf and is of practically the same value in the market; hence, wherever possible, it was favored in the markings in order to increase the stand of Loblolly in the second crop. A good beginning in fire protection has been made. One thousand acres have been set aside and an attempt will be made to protect this area thoroughly against fire. It is favorably situated, being completely surrounded by abandoned railroad spurs. These spurs have been cleared of rubbish and will act as excellent fire lines. A man who lives on this area has been detailed

to act as fire warden, under a contract which provides that he shall be paid only in case there is no fire, or, if a fire occurs, then if he can clear himself of contributory neglect; that he may hire assistants when necessary, that he must burn a fire line round the area once or, if necessary, twice a year, and that he shall keep the land thoroughly posted.

An experiment was made on this tract in burning the tops of felled trees, which are sources of great danger if fire once starts on cut-over land. It was found that to be burned successfully the tops must first be lopped and piled. If this method does not prove too expensive upon further trial, the tops on all cut-over lands will be dealt with in this way. An examination was made of the height at which stumps are now cut, and a report was submitted to the company showing the loss which follows from cutting high stumps.

In 1898 a working plan was made for the several wood lots included in the estate of Maj. W. A. Wadsworth, near Geneseo, N. Y. The owner desiring to put the plan in operation, the lands were visited by an agent of the Bureau of Forestry in the fall of 1901. The forest is composed of a mixture of hardwoods, and the main object is so to lumber it that its future productiveness will be assured. All trees to be cut were marked and stamped. The markings favored the more valuable Hickory, Ash, Black Walnut, and White Oak against the less valuable Beech, Maple, and Black Oak. The intention was both to aid the former in the present stand and to increase their relative proportion in the second growth which will follow the lumbering. All dead or dying trees were at the same time marked for removal. An excellent local market exists for lumber, cord wood, and ties. There is assurance that the cutting will prove a financial success and will tend to improve the forest.

The work in practical forestry on the 6,000-acre domain of the University of the South, at Sewanee, Tenn., goes steadily on. Trees containing approximately a total of 500,000 feet board measure have been marked for felling by the Bureau of Forestry, and the lumbering proceeds under its general supervision.

In the Adirondacks the tract of the Moose River Lumber Company has been added to those to which practical forestry is applied under the direction of the Bureau. In accordance with the recommendations of the working plan Spruce is being lumbered to a diameter of 12 inches. The marking of the trees to be cut, as well as the lumbering itself, is being carried on under the general supervision of the Bureau. An experiment is also being made in the conservative lumbering of the hardwoods.

The working plan for the tract of 110,000 acres upon the west slope of the Smoky Mountains in eastern Tennessee has been applied and lumbering has begun under the supervision of the Bureau. Contracts made for the sale of stumps include provisions recommended by the Bureau. These specify the kinds which shall be lumbered and fix the diameter limits to which they shall be cut. They provide against waste in lumbering and against unnecessary damage to young growth. It is further provided that trees cut in violation of the rules for conservative lumbering drawn up by the Bureau of Forestry shall be paid for at double the contract price.

Including lands not mentioned above, the total area of private forests actually under the supervision of the Bureau of Forestry is 372,463 acres.

FOREST MEASUREMENTS.

The force employed in computing field data was thoroughly organized as a section of the division of forest management during the past fiscal year and the effectiveness of its work notably increased thereby. This section now is equipped to handle all the figures of any kind gathered by the Bureau in its many lines of activity.

During the year the section of forest measurements worked up the figures and prepared the tables for the working plans made by the division of forest management and for the studies of commercial trees by the division of forest investigation. The data consisted of measurements obtained in 13 States and upon 25 species. It included surveys of the stand of timber upon 16,678 acres and analyses of 10,786 trees. These were cast into final tables of present and future stands and yields, of volume, and of rates of growth in diameter and height for the localities and species covered. With the exception of data obtained in the Black Hills Forest Reserve, which await further figures before they can be completed, the force engaged upon forest measurements has entirely finished the work for the field season of 1901, and has scaled also 10,000 acres of surveys left over from 1900.

EXPENDITURES.

The total expenditures during the year by the division of forest management were \$53,947.89, or 29.1 per cent of the total appropriation of the Bureau.

Of the \$13,325 contributed by owners as their share of the expenses in the preparation of working plans, begun or continued during the year 1901-2, \$9,160 had been expended at the end of the fiscal year.

WORK FOR THE ENSUING YEAR.

WORKING PLANS.

Public lands.—The field work necessary to a working plan for the San Francisco Mountains Forest Reserve will be undertaken, since the preliminary examination has established its advisability. Working plans will probably be begun for three other forest reserves, the preliminary examinations of which will be made during the current year.

Private lands.—The study of private forest lands, in the handling of which assistance has been requested under the terms of Circular No. 21, will be carried on as rapidly as the appropriation and the field force of the Bureau will allow. Particular attention will be given to the rendering of assistance in the handling of wood lots. The field work necessary to a working plan for the 1,250,000-acre tract of the Kirby Lumber Company in southeastern Texas will be undertaken, and also for the two tracts of the E. P. Burton Lumber Company, the one of 45,000 acres, the other of 6,000 acres, in South Carolina.

INSPECTION.

Forests under management.—Markings and inspection of lumbering will continue upon those forest lands already under the general management of the Bureau, and upon other lands for which their recommendation is approved in working plans already prepared or in process of preparation.

FOREST MEASUREMENTS.

The section of forest measurements will continue to work up all field results obtained by the Bureau. It will at the same time carry on field work within its own province.

COMMERCIAL TREES.

The purpose of the Bureau in this branch of its work is to complete during the ensuing year the studies of commercial trees already begun. The more important of these are the southern hardwoods, the southern pines, the Adirondack hardwoods, the Balsam in Maine and New York, the White Pine in Michigan, the Lodgepole Pine in the Middle West, and the Sugar Pine in California.

FOREST INVESTIGATION.

STUDIES OF COMMERCIAL TREES.

During the past year, both by this division and by the division of forest management, much valuable information was gathered for the discussion of the growth and yield of White Pine, Red Pine, White Oak, Scarlet Oak, Red Oak, and Aspen in Michigan; Sugar Pine in California; Balsam in Maine; and White Oak and Chestnut Oak in Tennessee, Kentucky, and Missouri. Similar data was collected for Lodgepole Pine in Wyoming and Montana, and for Western Yellow Pine in Arizona.

NEW ENGLAND HARDWOODS.

The study of New England second-growth hardwoods was continued by two field parties, and valuable facts were collected for the future discussion of their value and the best method of maintaining it.

The first draft of a study of the silvicultural characteristics of the Longleaf Pine was revised and enlarged. The study of the growth and characteristics of Loblolly Pine was not completed last year, partly on account of the illness of the expert in charge of the work and partly because his services were diverted to other urgent work. The report on this pine is now practically completed and the manuscript will soon be ready for the press. The study of the Sierra Big Tree in California and its exact distribution required additional attention, but is now practically finished. The maps and manuscripts will be ready for printing early during the present fiscal year. A study of the Bristle-cone Fir in southern California was completed and will shortly be ready for publication. The report on the Pacific Coast Redwood was prepared this year and awaits editorial revision. The report on Western Hemlock was completed and is in press.

SWAMP FORESTS.

A preliminary study of the factors which determine the distribution and best growth of swamp forests in eastern Missouri and Arkansas was begun last season. The timber trees concerned in this investigation are principally Cypress, Red Gum, and Black Gum. Little is known of the conditions most favorable to the reproduction and to the best growth of the Cypress, which is a timber of the first commercial value, or of the gums to be included in this study, the results of which are likely to be of practical value.

STUDIES OF NORTH AMERICAN FORESTS.

Michigan.—At the request of the Michigan forest commission a study was made of typical areas of forest and other lands in the

northern part of the southern peninsula of Michigan. The land examined is included in the State forest reserve, which contains some 60,000 acres of White, Red, and Jack Pine stump land.

A study of the reserve was made for the purpose of suggesting a plan for its proper management and for that of other similar lands in the same region, and recommendations were made to the commission.

Kentucky.—Investigations were begun last season on the forest conditions and resources of Kentucky, with special regard to the effects of destructive lumbering and of fire on the forest and its reproduction. A preliminary report of progress has been made, but another season's field work is required before a full report can follow.

Ohio.—A general examination of the forest resources of Ohio was begun last year to determine the location and extent of available supplies of commercial hardwood timber. In connection with this examination a study was begun of the relation of the wood-consuming industries of the State to existing supplies of timber. Search was made also for historical and other evidence to show the effect of denuding forest lands on the flow of streams. A report on the available tree species of the State has been submitted, together with a preliminary account of the consumption and principal sources of timber supply. The information in question is greatly needed to answer constant inquiries concerning supplies of Oak, Hickory, and other hardwoods.

A special study was begun of the moisture content of green wood. Tables have been constructed showing the percentage of water contained in samples of the green wood of seven commercial timbers of Ohio. This study will be extended and will form a basis for the determination of the best conditions for air-drying timber.

Texas.—The forest resources and general forest conditions of Texas were studied and a report which gives an accurate survey of the general and typical forest conditions of the State is nearly ready for publication.

New Mexico.—An examination was made of the forests on and in the region of the Sacramento Mountains. Particular attention was given to the relation of grazing to the perpetuation of the forest cover, and of the latter to the flow of water, which is of vital importance in contiguous agricultural regions.

Arizona.—Studies were made of the forests of Mount Graham, the Santa Catalina Mountains, the Huachucas, and the Chiricahuas. A portion of the forest lands of the Verde River basin was also examined, likewise with special regard to their relation to local water supplies. Aside from this question, the facts gathered will be of great service in answering frequent inquiries concerning the commercial timber supplies of these regions.

South Dakota.—The forest lands on and in the vicinity of Turtle Mountain, Short Pine Hills, and Slim Buttes were studied and reported upon for the same important purposes.

Wyoming.—An examination of the forest lands contiguous to the Yellowstone National Park was made with special reference to the grazing problem. The urgent need for protection of the local water and timber supply gave this work peculiar significance.

Montana.—A special study was begun in the Flathead Lake region of the terrestrial and climatic factors which influence the distribution

of certain types of coniferous forests. The practical object of this study is an accurate knowledge of the soil, climate, and other conditions most favorable to the development of the species considered. A preliminary report of the progress of this work has been submitted. Further field investigations are needed, however, before a full report can be made.

California.—The study of the relation of forest cover to the flow of streams, begun two years ago in southern California, was continued. The facts collected during two field seasons, have been partly elaborated, but require further study, which is being given. It is believed that a complete report of this investigation will be ready for publication early in the present fiscal year.

A general study was made of forest land in northern California with a view to its protection against fire, overcutting, and overgrazing. The examination covered altogether more than 2,000,000 acres.

Iowa.—Studies of the distribution, character, and value of forests in Iowa have been in progress for some time. It is expected that complete reports will be ready for publication at the close of the calendar year. The information will be of particular value to land owners of the Middle West.

COOPERATIVE INVESTIGATIONS.

California.—The study of forests in the Sierra Forest Reserve was again taken up in cooperation with the U. S. Geological Survey, and the unfinished south half of the reserve was completed. The purpose of this work was to make a description and classification of the forest and other lands within the reserve, to map the distribution of tree species and forest types, and to ascertain the condition, quality, and stand of commercial timber. The relation of these forests to various industries was considered, and the effects of forest fires on the growth and reproduction of the trees. An area of about 3,000,000 acres was examined. A report of the work of two field seasons, covering the entire Sierra Forest Reserve, is in preparation and will be completed early in the present fiscal year.

Vermont.—In cooperation with ex-Governor Smith, the Bureau began a general study of the forest resources and conditions of Vermont with a view to recommending a forest policy. A preliminary report was submitted and the complete report is in preparation.

Maryland.—The study of the forests of the best timbered counties of Maryland, begun in 1899 in cooperation with the State geological survey, was continued during last season under the same auspices. Reports on the timber resources and forest conditions of Cecil, Garrett, and Calvert counties have been prepared. Those on Cecil and Garrett counties are being published as a part of the report of the State geologist, while the Calvert County report will be published later.

Appalachian forests.—Descriptions of additional forest lands under consideration for inclusion in the proposed Appalachian Forest Reserve were completed during the past year. The results of this and the previous season's work, conducted in cooperation with the U. S. Geological Survey, were embodied in an elaborate report submitted to Congress and ordered published as Senate Document No. 84. The report is copiously illustrated by maps and photographs.

Its immediate purpose is to give reliable information upon the desirability and feasibility of establishing the Appalachian Forest Reserve. Aside from this purpose, the report embodies exhaustive data on the composition, condition, character, extent, and distribution of the forests of a little-known region.

EFFECTS OF GRAZING ON THE FOREST.

Investigations of the effects of grazing on the forest were conducted in the region included by the Yellowstone and present Teton forest reserves in Wyoming, in the Sacramento Mountains of New Mexico, in the Uintah Mountains of Utah, in the southern Sierras, and in the State of Washington. The purpose of these studies was to secure information which would permit a satisfactory regulation of grazing in regions where agricultural and other interests dependent upon water supply and upon timber have suffered as a result of excessive grazing.

STUDY OF FOREST FIRES.

A study of the effect of fires on the forest was conducted in Maine, Vermont, Michigan, Maryland, the Appalachian Mountains, Wyoming, Utah, Idaho, California, New Mexico, and Arizona. The examination of published forest-fire records was extended to a large number of Western papers. A discussion of the destruction caused by forest fires and the significance of the fire records now accumulated was embodied in a report which will be ready for publication during the present fiscal year.

DENDRO-CHEMICAL INVESTIGATIONS.

Under cooperative plans arranged last year between the Bureau of Forestry and the Bureau of Chemistry, the following dendro-chemical studies were carried on:

Commercial derivatives from native and exotic barks, woods, and gums.—Particular attention was directed to the quality and quantity of tan extracts produced by native woods and barks. The species studied include White Oaks, Black Oaks, Chestnuts, and Hemlocks. A number of gums produced in quantities by trees native of the Philippine Islands were studied with reference to the production of dammar and gutta-percha, and a large amount of work is yet to be done on similar material from the same source.

Standard pulp woods and untried species probably suitable for paper pulp.—The rapid exhaustion of the supply of standard pulp woods renders it imperative to discover, if possible, other equally useful species. To demonstrate the usefulness for pulp of certain plentiful timbers not yet used for that purpose will be exceedingly valuable if it can be done. Wherever supplies of such timber are present the life of the wood-pulp paper industry may be greatly extended.

The species being studied are White Spruce, Black Spruce, Red Spruce, Balsam Fir, Red Pine, White Pine, Loblolly Pine, Hemlock, *Arborvitæ*, Southern White Cedar, Aspen, Large-tooth Aspen, Cottonwood, White Birch, Basswood, Red Maple, Silver Mapie, Tulip-tree, and Black Gum.

The study of these woods embraces the preparation of pulp from their woods and the manufacture of commercial paper in accordance

with standard methods of manufacture. A detailed microscopic study is also being made of the wood fibers as an additional means of ascertaining the structural basis of the excellence or unfitness of certain fibers for the manufacture of paper. The paper produced will be subject to thorough tests, including the wear and strains to which they are subjected in actual use.

Removal of resin from fir pulp woods.—In connection with the general investigation of pulp woods a special attempt is being made to devise a cheap treatment which shall remove all the resin in fir woods, or at least a sufficient part of it, to permit its reduction to pulp by grinding without clogging the reducing stones.

TURPENTINE ORCHARDING.

The method of producing naval stores in the South is rapidly destroying the forests of the Longleaf Pine, a timber whose preservation is absolutely essential to the prosperity of that region. These facts led to an investigation of the production of crude resin by the Longleaf Pine, and an attempt to devise a more economical system. The survival of the naval stores industry depends absolutely on the abandonment of the old system of boxing and the introduction of a new method which will protect the life of the tree. The old system invites the destruction of the forest by fire and wind, as well as by the boxing itself. The Herty method of tapping, devised by Dr. C. H. Herty, a member of this Bureau, leaves the tree practically intact. By this method the resin, from two or more shallow streaks chipped on the trunk, flows into galvanized iron gutters which conduct it to an earthen pot hanging by a nail to the trunk of the tree. To test the new method in comparison with the old, 20,000 trees in strips intimately mingled were tapped. Great care was taken to make the comparison perfectly fair. The run of gum from sets of trees tapped for the first, second, third, and fourth times was collected and measured for each method. A bulletin giving in detail the results of the test is now in preparation. It is sufficient to say here that in quantity, quality, and economy of production the new method is decidedly superior to the old.

The acknowledgments of the Bureau are due to Mr. John H. Powell, of Ocilla, Ga., without whose assistance this experiment could not have been carried out.

COOPERATION WITH THE DIVISION OF ENTOMOLOGY.

In cooperation with the Division of Entomology, much attention has been given during the past year to the ravages of insects injurious to forests. Problems of the first importance to conservative forestry are presented by insect damage in the East and West alike. It may be cited as an example that the timber killed by insects in recent years in the Black Hills of South Dakota amounts to not less than 600,000,000 feet B.M.

VARIOUS STUDIES.

A history of the lumber industry in the State of New York.—This study, prepared by the superintendent of forests of the State of New York, was completed during the year, and has recently appeared as Bulletin No. 34 of this Bureau.

Osier willow industry in the United States.—An exhaustive study was made of the status of the osier willow industry in this country. Important statistical data, hitherto unpublished, were compiled and supplemented by original inquiries. A representative of the Bureau studied on the ground the growth and management of American osier plantations, and added a thorough survey of the osier willow culture in foreign countries. A bulletin embodying the results of these investigations is nearly ready for publication. There is a widespread call for the information it will contain.

Tree growth on burned lands.—The study of burned mountain slopes in southern California was continued during the year. Special attention was given to the study of natural reseeding from surviving trees, and to experiments in direct seed planting of Western Yellow Pine, Torrey Pine, and Monterey Pine, in denuded sections. Since the spring rains very encouraging results have followed this seeding. With the exception of the Yellow Pine, the species named are of little direct value, but a protective cover of these trees will make possible the later introduction of more useful timbers. Strong local sentiment was aroused by this work, and the agent in charge has been given cordial support and assistance from settlers in collecting seed and in planting it.

Eucalypts cultivated in the United States.—A careful study was made of the distinguishing characteristics, culture, uses, and distribution in the United States of about 40 species of Australian Eucalypts, and the results of these studies were embodied in a bulletin which is now in press. Collectively, the information made available in this bulletin is nowhere else accessible. It will give information much needed and often requested by correspondents of this Bureau.

Acacias cultivated and naturalized in the United States.—A similar study was made of the Acacias cultivated and naturalized in the United States, but the report is not yet ready for publication. Information concerning these trees is in constant demand by correspondents of the Bureau in the Southwest.

TIMBER CONSTRUCTION AND SUPPLIES.

Durability of treated and untreated railway timber.—In cooperation with the Bureau of Plant Industry, the durability of timber used for construction, and particularly of railroad timber, was given thorough attention. Large quantities of railroad ties, contributed and transported without cost to the Department by various companies, were laid in the roadbed under test conditions.

The value of insect-killed timber, both treated and untreated, for various purposes was carefully investigated, and great interest in various questions was aroused among the mining and railroad companies. Widespread support and encouragement was given by the latter in various ways. This work, continued from previous years, is among the most promising in which the Bureau of Forestry has been engaged.

EXPOSITIONS.

The forest exhibit installed at the Pan-American Exposition on June 20, 1901, remained on exhibition until November 1, 1901, when, with the exception of the two largest transparencies, it was moved to Charleston, S. C., and installed there on December 30, in the South

Carolina Interstate and West Indian Exposition. The only new feature of the exhibit at Charleston was the addition of 70 samples of commercial woods from the Philippine Islands. At the close of the Charleston Exposition one-half of the exhibit was installed at the New England Association of Arts and Crafts, at Providence, R. I., where it now is; the remainder of the exhibit was boxed and shipped to Washington, D. C.

IDENTIFICATION OF FOREST SPECIMENS.

Much time was consumed in the division of forest investigation in identifying specimens of native and exotic trees and samples of commercial woods. An important service was rendered to the Tennessee and Virginia Boundary Commission by the identification of the species of witness trees and the determination of the ages of blaze marks upon them.

EXPENDITURES.

The total expenditures of the division of forest investigation during the fiscal year were \$55,468.84, or 29.9 per cent of the total appropriation of the Bureau.

WORK FOR THE ENSUING YEAR.

DENDROLOGY.

Monographic studies of the White and Black Oaks and the osier willows will be continued, and studies will be begun of the Sugar Maple and the Western Cottonwood. Investigations of the forest floras of important regions will continue.

FOREST DISTRIBUTION.

A study of the character, extent, and value of forests in the best-timbered counties of Maryland will be continued in cooperation with the Maryland State geological survey. Studies of forest conditions and forest resources will be carried on in Vermont, Michigan, Ohio, Kentucky, Iowa, Montana, and California. Special forest problems concerning types of forests in Texas, Arkansas, and Missouri will also be taken up.

STUDY OF FOREST PRODUCTS.

Dendro-chemical investigations.—Chemical investigations of woods, barks, and gums to determine their production of tan extracts and of the adaptation of untried pulp woods for the manufacture of paper pulp will be continued in cooperation with the Bureau of Chemistry. The lines of this work will be considerably broadened to include examinations of new material and the manufacture and testing of papers made from untried woods.

Removal of resin from pulp woods.--In connection with the investigation of pulp woods, experiments will be continued to devise a method of cheaply removing resin from fir woods in order to facilitate their reduction by grinding to pulp. Similar experiments will be made also with inferior pine woods, which, if freed from resin, can be used for certain grades of paper.

MECHANICAL, AND OTHER PROPERTIES OF LEATHER PREPARED BY TAN EXTRACTS FROM DIFFERENT NATIVE TANBARKS.

An investigation to determine the mechanical properties of leather from different tannages will be begun at the request of a leading manufacturer of American leathers, upon samples to be furnished by him and other manufacturers. This study follows naturally upon the investigation of tan barks already mentioned. It is expected to yield important results upon the comparative wearing qualities of leathers prepared by various tannages.

CONIFEROUS PRODUCTS.

Turpentine orcharding.—This investigation will be continued for this season along the lines already described. A comparative study of European and American methods on the ground will be undertaken and should be of very great advantage to the development of the new method now under experiment.

Distillation of pine woods.—The preliminary study already made of the distillation of waste Longleaf Pine butts for the production of turpentine and other by-products will be continued, with a view to its application to waste pine tops.

FOREST STATISTICS.

An effort will be made to begin the collection of data showing past and present consumption of raw and manufactured wood of various kinds for all purposes. The investigation is planned to include a considerable number of American and foreign woods in home and foreign markets and the production and value of forest by-products.

PRESERVATION OF WOOD.

The mechanical treatment of railway and other construction timbers with preservatives to increase their durability and comparative studies of the behavior and durability of treated and untreated timber in actual service will be continued. Further study of the causes of decay in timber and methods of prevention will be made. These investigations will be conducted in cooperation with the Bureau of Plant Industry.

TIMBER TESTS.

In cooperation with the Bureau of Chemistry, a series of tests to determine the strength of the principal merchantable timbers of the United States has been commenced. There is an urgent and widespread demand for reliable information of this kind, and it is intended to take up the work in a very thorough way. The Division of Forestry began in 1891 tests which related principally to the southern pines and which in 1896 were discontinued. Beyond this no systematic tests of American timbers have ever been made.

The work in timber testing now undertaken by the Bureau of Forestry will be of direct practical value to engineers and to others interested in the utilization of timber. Testing stations have already been established at Washington, D. C., and at New Haven, Conn., the latter in connection with the Yale Forest School, and their number will be increased as rapidly as possible. Experienced engineers will be employed in the laboratories, and the material will be collected by trained men.

FOREST ENTOMOLOGY.

In cooperation with the Division of Entomology, the study of the relation of injurious insects to practical forestry will be continued, and will include an investigation of the relation of insect pests to American osier willow plantations.

MISCELLANEOUS INVESTIGATIONS.

Pacific Coast Tan-bark Oak.—A thorough investigation will be made of the distribution and available commercial supplies of the Tan-bark Oak of the Pacific slope. Special attention will be given to the growth of the tree and its methods of reproduction. The importance of this investigation is very great, since the supply of this bark, which is the most valuable in the West, is rapidly decreasing, and its place can not be taken by material from any other western Tan-bark Oak.

Pacific cedar-shingle industry.—A study will be made of the cedar-shingle industry of the Pacific coast region. The industry will be investigated at the principal manufacturing centers, while a careful study will be made in the forest of the distribution, character, and extent of cedar timber available for shingles. So far as it is possible during the present season, a study will be made of the reproduction and silvicultural characteristics of this cedar.

RECORDS.

QUARTERS.

At the beginning of March, 1902, an entire floor of the Atlantic Building was added to the quarters of the Bureau. This addition was required by the congested condition of the rooms on the seventh floor. It permitted a rearrangement of the offices, the installation of the library, and the assignment of quarters to the photographic laboratory, hitherto in the building of the Bureau of Chemistry by the courtesy of the chief of that Bureau.

LIBRARY.

The transfer of the main collection of forest literature from the Department Library to the quarters of the Bureau was prevented by lack of space until March, 1902, when a large room was equipped for library purposes. The library now contains 1,120 bound volumes, 1,900 pamphlets, and files of 28 current forest and lumber-trade journals, including French, English, and German periodicals. There were added during the year 3,821 clippings from newspapers relating to forest work. The library staff was increased by the appointment of two librarians, making it possible to classify properly much valuable material collected in former years and to keep abreast of the current work.

The photographic collection was largely increased. Prints to the number of 3,643 were added during the year. Of this number, 3,235 photographs were taken in 42 States and Territories, and 408 forest photographs were received from foreign countries, including excellent collections from India, Switzerland, and Germany. These were classified, catalogued, and filed.

The collection now numbers 6,059 prints. Every State and Terri-

tory, including Alaska, Porto Rico, and the Philippine Islands, is represented. The collection of lantern slides now numbers about 1,000, of which over 400 were added during the year. Loans of 476 slides were made to 13 persons during the year.

CORRESPONDENCE.

As in preceding years, close attention was given to the expeditious handling of correspondence. Notwithstanding the large increase of mail matter, all letters received were promptly referred for attention, and, with few exceptions, were acted upon and acknowledged within thirty-six hours. The number of pieces of mail matter forwarded from the Bureau during the year was 24,538.

MAILING LISTS.

The mailing lists of the Bureau are the following:

- (1) A special list of libraries.
- (2) A list of representative newspapers.
- (3) A small foreign list of journals, libraries, and individuals engaged in forest work.
- (4) A special list of persons engaged in forest work in the United States.
- (5) A general list of persons interested in forestry.

The first four lists, which number together 2,817 addresses, receive all publications of the Bureau as soon as they are available. To the general list are sent the reports of the Forester, reprints of the contributions from the Bureau of Forestry to the Yearbook of the Department, and circulars of information. Cards are also sent, giving notice of the appearance of bulletins, with brief descriptions of their contents. Applications for these bulletins, made in response to the card notices, are honored in the order of their receipt. The number of addresses on the general list is 5,056.

PUBLICATIONS.

New publications.—During the year eight new publications appeared, as follows:

	Copies.
Bulletin No. 31	7,200
Bulletin No. 32	10,000
Circular No. 23	10,000
Extract No. 212	15,000
Extract No. 214	10,000
Extract No. 236	5,000
Report of the Forester for 1901	10,000
Farmers' Bulletin No. 134	10,000
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Press Bulletins (Nos. 14, 15, and 16)	77,200
	<hr/>
Total	89,200

A word of explanation is required concerning the number of new publications issued, without which it would seem that the publication of results had not by any means kept pace with the Bureau's activity in other directions. While but 2 new bulletins have appeared, as against 3 in 1901, there are now in course of publication 4 new bulletins, the manuscript of a fifth is completed and awaiting the beginning

of the new fiscal year before being submitted, and 2 additional extracts from the Yearbook will appear shortly. It is thus true that the work of publishing results has been carried on much more rapidly than ever before.

Reprints.—Ten reprints of former publications were printed, as follows:

	Copies.
Bulletin No. 7	1,000
Bulletin No. 10, first edition	2,000
Bulletin No. 10, second edition	1,000
Bulletin No. 12	2,500
Bulletin No. 17	1,000
Bulletin No. 26	3,000
Bulletin No. 29	10,000
Bulletin No. 30	10,000
Circular No. 23	2,000
Extract No. 212	10,000
Farmers' Bulletin No. 134 (various reprints)	85,000
Total	127,500

In addition to the reprints listed above, the following are now in course of publication:

	Copies.
Bulletin No. 6	2,500
Bulletin No. 8	2,000
Bulletin No. 13	2,500
Bulletin No. 22	1,000
Bulletin No. 28	10,000
Total	18,000

PHOTOGRAPHIC LABORATORY.

Owing to lack of space at the quarters of the Bureau of Forestry, the photographic laboratory remained, as already mentioned, until recently, in the building of the Bureau of Chemistry, through the courtesy of the chief of that Bureau. With the acquisition of the eighth floor of the Atlantic Building it was possible to assign sufficient quarters for the equipment of a photographic laboratory. The work of installing the equipment is now completed. An enlarging and reducing camera of large size was purchased, and the laboratory is now thoroughly equipped in all branches of photographic work, including map photography, enlarging, reducing, and wet-plate work.

The work of the laboratory during the year was very satisfactory. Five thousand three hundred and thirty-two films and plates were developed, 9,695 prints were made, and altogether 20,884 items of work were performed.

INSTRUMENTS AND SUPPLIES.

Instruments.—The rapid extension of the work of the Bureau in the field made heavy demands for additional instruments, while experience in the woods suggested improvements in the construction of several types. A very small percentage of field equipment was lost or damaged beyond repair, for the members of the field parties were generally careful in the handling and use of the instruments. The total expenditure for instruments during the fiscal year was \$7,245.61, or 3.9 per cent of the total appropriation.

Supplies.—With the exception of \$400 from the contingent fund of the Department, all furniture, typewriting machines, stationery, and supplies of all kinds have been purchased from the funds appropriated for the Bureau of Forestry. This expenditure was \$10,200.74, or 5.5 per cent of the total appropriation.

Accounts.—At the beginning of the fiscal year 1902 a system of accounts was introduced, the principal object of which, in connection with the proper preparation and handling of vouchers for the payment of salaries and expenses, was to furnish at all times an accurate, comprehensive, and permanent record of the condition of the appropriation for the expenses of the Bureau, and of the several allotments made by letters of authorization for the traveling expenses of members of the Bureau engaged in field work. A system setting forth in detail the allotments and liabilities of every class has been submitted at the end of each month to the chief of the Bureau.

TREE PLANTING.

The work of this section has broadened steadily during the past year. Cooperation with forest planters under the provisions of Circular No. 22 was widely extended, met with a high degree of public appreciation, and remains the most important work with which the section is charged. Other lines of work of equal promise originated during the year. The first National reserves for the distinct purpose of forest planting were established. It was fairly proved that some lands, hitherto considered incapable of doing so, will stock themselves without planting, if well directed assistance is given to the natural reproductive power. The reclamation of the coast sand dunes by forest planting was for the first time undertaken by the Bureau.

COOPERATIVE PLANTING.

On June 30, 1901, there had been received in response to the offer of cooperation with forest planters, announced in Circular No. 22, a total of 192 applications for assistance. For 173 applicants planting plans had been prepared, in the course of which 113,842.3 acres were examined. Probably 10 per cent of this area will be planted within twelve or fifteen years, but the detailed plans, made in consequence of the examinations, covered but 3,057 acres, which is the area to be planted within three or four years from the date of the plans. Where the planting was not extensive, in many cases it is now complete and in others it is near completion, for many landowners began planting at once on receipt of their plans.

This planting has generally given satisfactory results. For example, at Fowler, Kans., the main part of a wood lot of 12 acres has been established without losing a single tree. At Enid, Okla., satisfactory results were obtained in establishing a wood lot of 5 acres. In a few instances the planting has been temporarily deferred, and in two cases the agreements have been canceled because they could not be carried out by the owners.

During the past fiscal year 70 applications for assistance were received and 51 planting plans were made. There was examined an area of 83,596.9 acres, a large percentage of which is subject to planting. The area actually covered by the plans made during the year, and to be planted within the next two or three years, is 3,417.57 acres.

The total number of applications to June 30, 1902, is 262, the number of plans prepared 224, the area examined, 197,439.2 acres, and the area to be planted, 6,474.32 acres. Thirty-eight applications await attention.

The plans represent 29 States and Territories and 172 localities. In addition, personal advice and instruction have been given in these localities to many other planters. It has been the practice of the representatives of the Bureau in this work to attend and address local meetings when such are called in the interest of forestry by the citizens of a community where work is being done. At Anthony, Kans., where such a meeting was held last summer, over 500,000 trees were set out this spring in consequence, in addition to the planting under plans regularly prepared in that locality.

Planting under this year's plans has several purposes. Protective shelter belts and farm wood lots have generally been the object in the Middle West. Several commercial plantations are being developed in Oklahoma, Kansas, and Nebraska for fence posts and telegraph poles, though none is of great extent. An average example is a plantation at Stafford, Kans., which covers 30 acres and has for its object the production of fence posts. The Middle West has comparatively little nonagricultural land, and except for the production of fence posts, telegraph poles, and railroad ties, forest planting will not as a rule be practiced by individual planters on a larger scale than farm wood lots and shelter belts. The Eastern States have a high percentage of land adapted only to forest purposes, a good part of which has been stripped of timber beyond the hope of natural reproduction. Such land often lies within reach of good lumber markets. In many places in New England land worth from \$2 to \$5 per acre can be stocked with White Pine at fair annual profit on the investment, reckoning lumber at present prices and a period of growth of from forty to sixty years, and this has encouraged many land owners to begin planting on their idle lands.

An increasing amount of forest planting is being done for the purpose of protection, and this Bureau is giving practical aid in several cases of this nature. For example, the most extensive planting in New England is being done by the Metropolitan Water and Sewerage Board of the Commonwealth of Massachusetts, for the purpose of protecting from silt the immense reservoir under construction at Clinton, Mass., to supply Boston and surrounding cities with water. Seed beds, in preparation for this planting, were established two years ago. Planting was begun this year under plans prepared by the Bureau and carried forward with a force of 48 men under the immediate direction of a forester privately employed. One hundred and seventy-five acres were planted. It will require three years more to complete the planting at present planned, which will cover 1,500 acres. Seedlings are already on hand for the planting of this area, which is, however, but half of that which the plantation will eventually occupy.

In no case has the Bureau furnished seeds or trees or participated in any degree in the expense of planting. Its outlay is limited to the expenses of its agents in making the preliminary examinations and planting plans.

STUDIES OF PLANTED WOODLANDS.

Reliable advice and instruction in forest planting must be based upon a thorough knowledge of the purposes for which planting is

practicable, and of the methods to be economically employed in various regions. This knowledge can be obtained only by an exhaustive study of plantations already established. Such a study was vigorously pursued, during the past year, along the lines already established, in 20 large plantations, 8 of which are located in the Middle West and 12 in the East. The study of the Hardy Catalpa for economic planting was completed, and a bulletin based upon it is in press. A study of the White Pine for economic planting in New England is in progress, and a report is in course of preparation.

Closely connected with these investigations is a study now under way with the object of finding trees better adapted to the Southwestern plains than those hitherto in use. Types of trees injured to hard conditions of climate and soil in other regions are being introduced, in the hope that trees thoroughly fitted for the situation may be discovered.

STUDIES OF FOREST EXTENSION.

The study of the practicability of forest extension by assisting natural reproduction was begun two years ago in the timber belts which project into the prairies along the streams of the Middle West. During the past year this study was much advanced by a forest survey which included a large portion of Nebraska. It was found that the forests of that State, which consist mostly of narrow belts along the streams, have extended over large areas of prairie land within the last twenty-five years, where they were protected from fire and stock. It is estimated that in eastern Nebraska, where the timber is confined to hardwoods, the growth of the forest through its encroachment on prairie land amounts to not less than 400 square miles. The extension of the forest is noticeable on almost every stream and ravine. The forest is known to have traveled up certain streams as much as 2 miles and to have taken complete possession of tracts of 80 to 100 acres of prairie lands within the last twenty-five years.

A knowledge of how to assist natural reproduction effectually will be useful throughout the Middle West, where there are hundreds of scantily wooded stream valleys which should support a heavy stand of timber. Such knowledge will also be of much use in dealing with the denuded lands in the Eastern States, especially where reproduction has been prevented by repeated fires. It is likely to be of greatest value, however, on the National forest reserves, where the stand of timber is often deficient and in the management of which time is often a less important factor than on private lands.

RESERVE PLANTING.

The first step in this important work was taken this year. In the forest survey made in Nebraska, convincing evidence was found of the adaptability of the sand-hill district of that State to the growth of forest trees. Bull Pine and Red Cedar are spreading over the hills naturally near the Niobrara River, a decided tendency toward shrub growth exists throughout the district, and the Government's experiment in planting conifers, made nearly fifteen years ago, has been attended with marked success. At the recommendation of Senator Dietrich, of Nebraska, supported by the Bureau of Forestry, the President, on the 16th of last April, established in the sand-hill region two forest reserves of a joint area of 208,902 acres. With the

consent of the Secretary of the Interior, the Department of Agriculture will establish nurseries and undertake forest planting on these reserves. Preparation for the work was begun this spring, and similar work on other reserves is about to begin.

SAND DUNES.

Work on the control of sand dunes by forest planting was begun for the first time during the past year. Dune control has become important in several parts of the country where serious damage is threatened to valuable property by the encroachment of sand. In southern Virginia and northern North Carolina a chain of immense sand dunes stretches north and south along the coast. These dunes are moving slowly landward, and within the last few years have become dangerous to the United States life-saving stations and to private property of large value. Last fall, at the request of a number of private owners, the Bureau made an examination of a district in Currituck County, N. C., and began work at one point to fix the drifting sand sufficiently to permit forest planting. In cooperation with the owners of the land, board fences and other structures were erected to alter the course of the most threatening dunes and to clear the superfluous sand from a plain about certain valuable buildings. The work was so successful that this spring the ground was in condition for the planting of beach grass, which is being used temporarily as a cover. With a fair growth of grass this season, forest planting on from 30 to 50 acres may be begun next spring. The forest, besides protecting the buildings, will yield a much-needed supply of fuel. At other points in the same district, which extends 30 miles along the coast, the Bureau is now giving similar aid. In addition to its direct use this work will have great value as an object lesson in dealing with the sand.

An investigation is also being made of the dunes formed by the drift sand along the Columbia River in Washington and Oregon. The dunes are destroying valuable orchards and rich agricultural lands. They form serious hindrances to transportation along the lines of the Northern Pacific Railway and the Oregon Railroad and Navigation Company. After a careful examination the Bureau will attempt to devise methods for controlling the movement of the sand. The Oregon Railroad and Navigation Company is assisting in the investigation.

EXPENDITURES.

The expenditures of the section of tree planting for the year were \$16,616.86, or 8.9 per cent of the total appropriation. Of this amount 53 per cent was for salaries and 47 per cent for field expenses.

WORK FOR THE ENSUING YEAR.

The work in cooperative planting is giving highly satisfactory results and will continue unchanged. Increased attention will also be paid to protective planting, especially in the Eastern States.

Preparations for extensive planting on the Dismal River and Niobrara forest reserves in Nebraska will be pushed forward as rapidly as possible. Seed beds and nurseries are being put in readiness. A large collection of seed will be made this fall and nursery work will begin. Examinations will be made of other forest reserves, notably

those in Oklahoma, Colorado, Arizona, and southern California, to determine the advisability of systematic planting.

Careful studies will be made in Oklahoma and Arizona during the year to find methods of extending the present forest stand by improving the conditions for natural reproduction. In both regions field parties are already at work.

The reclamation of sand dunes, both along the coast and in the interior, is one of the large problems before this Bureau. Two field parties, one on the Atlantic coast and one on the Columbia River, will continue to investigate this problem during the present season.